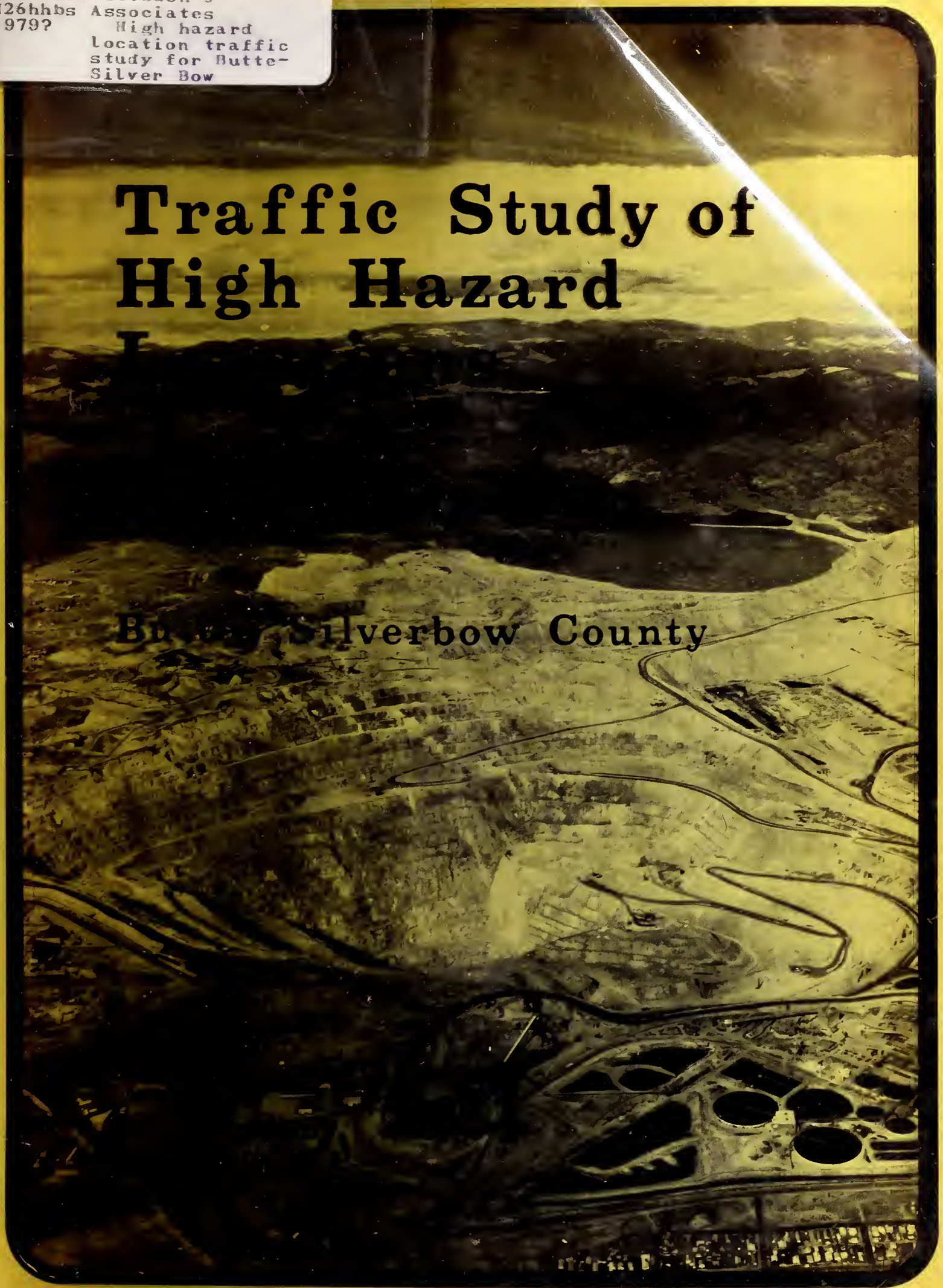
Traffic Study of High Hazard



Silverbow County

EXECUTIVE SUMMARY

HIGH HAZARD LOCATION

TRAFFIC STUDY

FOR

BUTTE-SILVER BOW

PREPARED BY

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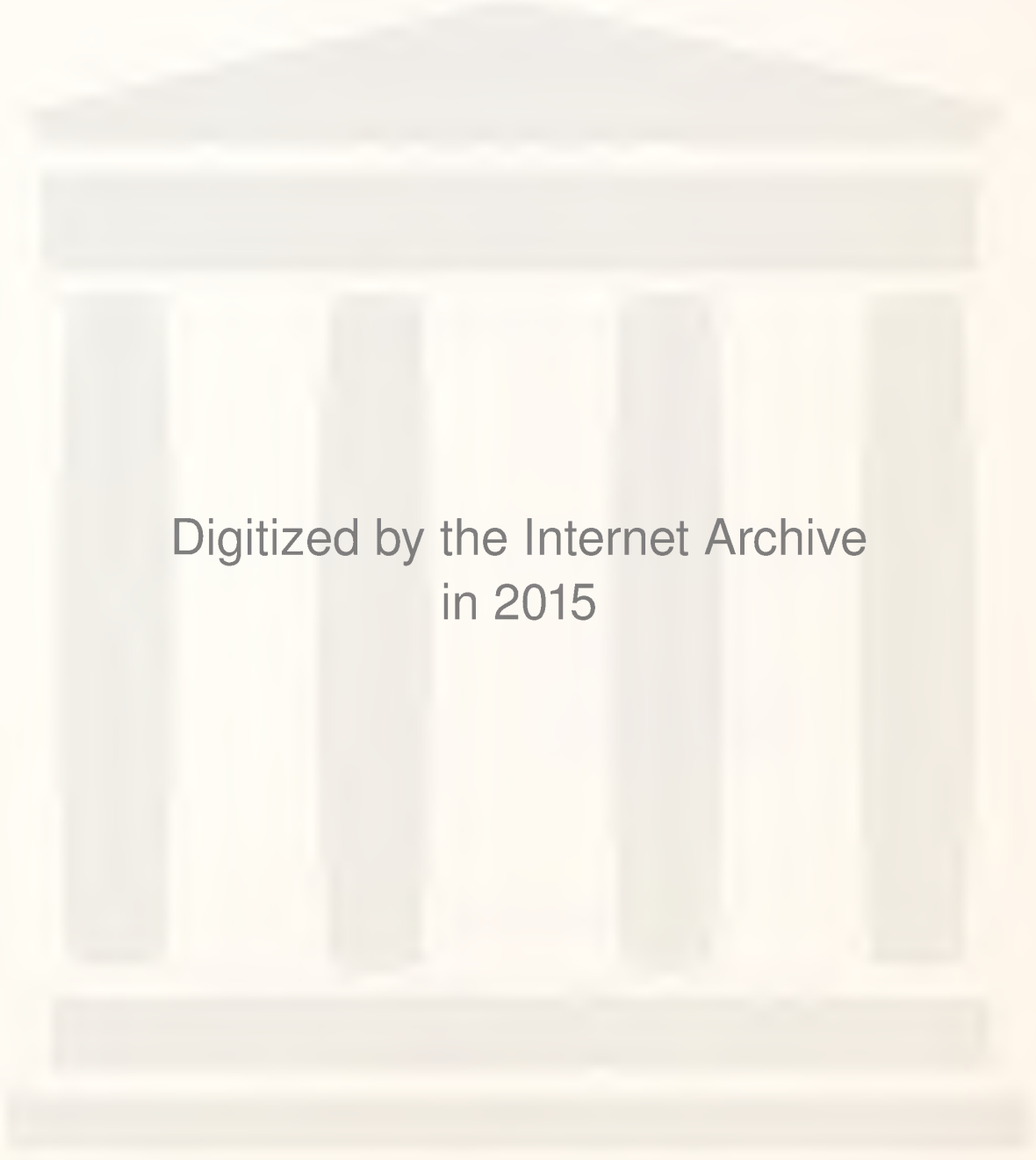
BILLINGS, MONTANA



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INTRODUCTION

PURPOSE AND SCOPE

Butte-Silver Bow had embarked on a project to eliminate or alleviate existing problems at high hazard accident locations. With the preliminary technical and organizational assistance of the Department of Community Affairs, Highway Traffic Safety Division, twenty sites were selected for study.

The method of selection was based primarily on number of accidents at defineable locations. Even though many variables exist in the determination of hazardous locations, Butte-Silver Bow desired maximum impact as a result of the study and therefore chose a quantitative approach.

Since Butte-Silver Bow's road system is of an urbanized nature, major accident clusters occurred at intersections. The majority of sites are on Federal Aid Urban or Urban Extension routes which fall under a joint jurisdiction between Montana Department of Highways and Butte-Silver Bow.

The basic intent of this study was twofold.

1. To analyze each site relative to the degree of hazardness and establish a priority ranking for improvement projects based on the composite hazard ranking and cost-benefit ratios.
2. To provide a vehicle for Butte-Silver Bow to continue the program in the future.

The analysis contained within this report is based primarily on Report No. FHWA-RD-77-83 "Identification of Hazardous Locations" as refined by DCA Project No. 79-04-01-01. Modifications to these reports were made after intensive testing and error analysis. The methodology used to establish priority rankings

was tailored to Butte-Silver Bow's requirements and provided for flexibility in the analysis of county road system characteristics.

This report briefly presents the method of study and results of the analysis along with recommendations for priority improvements and program continuation. Other details of the study can be found in the main report.

STUDY METHODOLOGY

BASIC STUDY OUTLINE

The study was segregated into three distinct phases which best achieved the purpose and scope of the traffic study. These phases are outlined as follows:

Phase 1 - Data Collection Phase; included the preliminary organization of the project including scheduling, form processing, field data collection and reduction of data. Accident data was obtained from reports filed at the Police Department and the Department of Highways. Traffic counts were taken at each location. The average daily traffic was determined by applying factors for hourly, daily and monthly variations.

Other data collected in the field included measurement of road widths and geometrics, an inventory of traffic control devices, turning movement counts and subjective observation of traffic operations.

Phase 2 - Analysis of Data; included the determination of hazard indices for each location by using the Federal Highway Administration Report No. FHWA-RD-77-83 "Identification of Hazardous Locations" and DCA Project No. 79-04-01-01 report. Computations involved with accidents, volumes, capacities, indicator values and other aspects of hazard indices were performed. From these computations a preliminary hazard ranking list was assembled.

Phase 3 - Evaluation of Corrective Measures and Priority Listing: included the determination of improvements that would reduce or eliminate certain types of hazards or hazards in general at the accident locations. Preliminary designs of those improvements included signing, geometric changes, signal modifications, channelization and reconstruction. The improvements were recommended on a short term basis. In some cases, long term improvements were recommended.

Cost effectiveness calculations of the improvements at each location were determined by preparing preliminary cost estimates and computing economic benefits to arrive at a cost-benefit ratio. The composite hazard index ranking and cost-benefit ratio determined the final priority listing.

COST-BENEFIT RATIOS

Costs - are developed by preliminary estimation of required quantities based on current prices as tabulated from average bid prices of similar projects. The costs should in no way be considered a quote or final estimate of actual work.

Even though Butte-Silver Bow maintenance crews are capable of performing a good deal of the work, the costs are based on contract prices in order to correlate with costs requiring contract bid letting. The costs also do not include administrative, design details or field layout which is required in some recommended improvements. Engineering design will generally be required to produce contract plans and specifications. These costs should be evaluated prior to planning improvement projects.

Benefits - are estimated by applying accident reduction forecasts based on the type of improvement recommended. The forecasts are based on the subjective evaluation by an experienced traffic engineer. This evaluation is aided by knowledge of accident experience at similar intersections with the improvements existing. Also statistical studies relating certain improvements to accident reduction are used as a guide ie, Roy Jorgenson and Associates, "Evaluation of Criteria for Safety Improvements on the Highway" (Washington, D.C.: U.S. Bureau of Public Roads, Office of Highway Safety, 1966, p. 316).

The forecasted reduction is expressed as a precentage of each type of accident. This percentage is multiplied by the percentage of all accidents represented by each type. The total percent reduction of all accidents at each site is the sum of all accidents reduction percentages for each type.

The basic formula used to compute benefits in this report is:

(% Reduction) x (Accidents/Year) x (Useful Project Life)

x (Average Severity in Dollars)

Where:	% Reduction	=	Fractional Reduction of all Accidents
	Accident Rate	=	Number of Accidents ÷ Number of Reporting Years
	Useful Project Life	=	5 years for signing projects, 20 years for reconstruction
	Average Severity in Dollars	=	Data Value of Accident Severity shown on Hazard Index Computation Sheet

If applied consistently the economic benefit computation will provide a realistic estimate of average economic savings to the general society. The benefit amount should not be interpreted as a dollar value that Butte-Silver Bow will receive as a result of dollar outlay. It is just a figure used to quantify the economic benefit to society that would occur if a certain number of accidents did not occur.

Ratio - of costs to benefits provides a reference as to the value of the recommended improvements. It is the desire of any improvement project to have a cost-benefit (C/B) ratio less than 1.0. If the C/B exceeds 1.0 the project is not justified. The value of a project is therefore inversely proportional to the value of the C/B.

STUDY CHARACTERISTICS

Various traffic characteristics are prevalent among regions of the United States. Characteristics may also vary between states, cities, counties, and between lesser finite areas depending on the type of characteristics examined. As part of any traffic study with the objectives of identifying hazardous sites to improve safety or efficiency of the traffic carrying system, it is important to know the characteristics of traffic flow, driver behavior, and other factors affecting traffic operations. Therefore as an integrated part of this study, the distinct characteristics of the Butte-Silver Bow area were incorporated in the analysis of accidents and subsequent recommendations for improvements.

Traffic Volumes

All available data that had been assembled by the Montana Department of Highways was examined and interpreted to provide annual Average Daily Traffic (ADT) expansion factors. In addition to this data, 24-hour automatic counters were set out at all of the high hazard sites to provide current ADT as well as provide hourly variation factors. Turning movement counts were taken for the most part at peak evening and morning hours and in some cases during more normal operational periods of the day. The turning counts prove invaluable in detecting improper geometrics for turning volume conditions and also provide a basis on which to modify signal timing and progression.

System Characteristics

It was observed during the course of the study, that the urban area of Butte-Silver Bow contains a heterogeneous mixture of modern state of the art traffic control devices and various control measures that have been outdated for some time. For the most part, the entire area is devoid of signing and pavement markings. Areas which do provide a degree of modern signing and pavement marking are often deficient in one or more aspects of standards as presented in the Manual of Uniform Traffic Control Devices (MTCD). The non-uniformity of traffic control devices is a serious problem and can be a major contributor to accidents since driver expectancy is violated.

The street systems within the City proper have been aligned and constructed since the turn of the century. Narrower streets, sandwiched between multi-story buildings in the uptown area present on a reduced scale, all of the turning movement and vehicular-pedestrian conflicts of larger metropolitan cities.

Streets constructed in an area commonly known as the "Flats" follow a more conventional alignment than the CBD area. However, pertinent road structures, particularly curb and gutter which are considered necessities in most urban areas, are seriously lacking. Curb and gutter which provide positive drainage and protects the subbase structure, also is a valuable traffic control device. Barrier curb systems, not only delineates the edge of the road but also provides a means of controlling approach traffic onto the traveled street section.

Of particular concern within the City of Butte is the problem of parking. At almost every site, parking characteristics played a major role in creating site distance restrictions which were contributory to numerous accidents. The wide spread practice of double parking in the driving lane, particularly

in the uptown or Central Business District of Butte, presents serious operational and traffic safety problems. Historically, the problem had existed in Butte for a number of years. It is not known whether enforcement policies have ever resulted in any degree of improvement. It is apparent that the parking problems are sufficient to justify a parking study within the city to determine the adequacy of available parking in the CBD. Commercial deliveries seem to create the most significant problems. The sites where double parking violations were observed are: Site 1 (Mercury), Site 3 (Platinum) Site 13 (Wyoming), Site 15 (Olympia), Site 16 (Main & Broadway), and Site 17 (Main and Granite). If local knowledge of specific problem areas can be obtained, perhaps commercial loading zones or other methods of parking control can be initiated at some locations.

Driver Characteristics

The safe and efficient operation of any street system is heavily dependent upon the characteristics of the drivers using the facilities. It was observed during the course of the study that an overall violation of traffic laws occur in significant proportions. It is believed that the driver behavior is directly influenced by the character of the street systems within Butte. The unfamiliarity of area drivers with standard traffic control devices is evident. More widespread and uniform use of modern standard traffic control devices along with an aggressive enforcement program will undoubtedly improve driver behavior over a period of years.

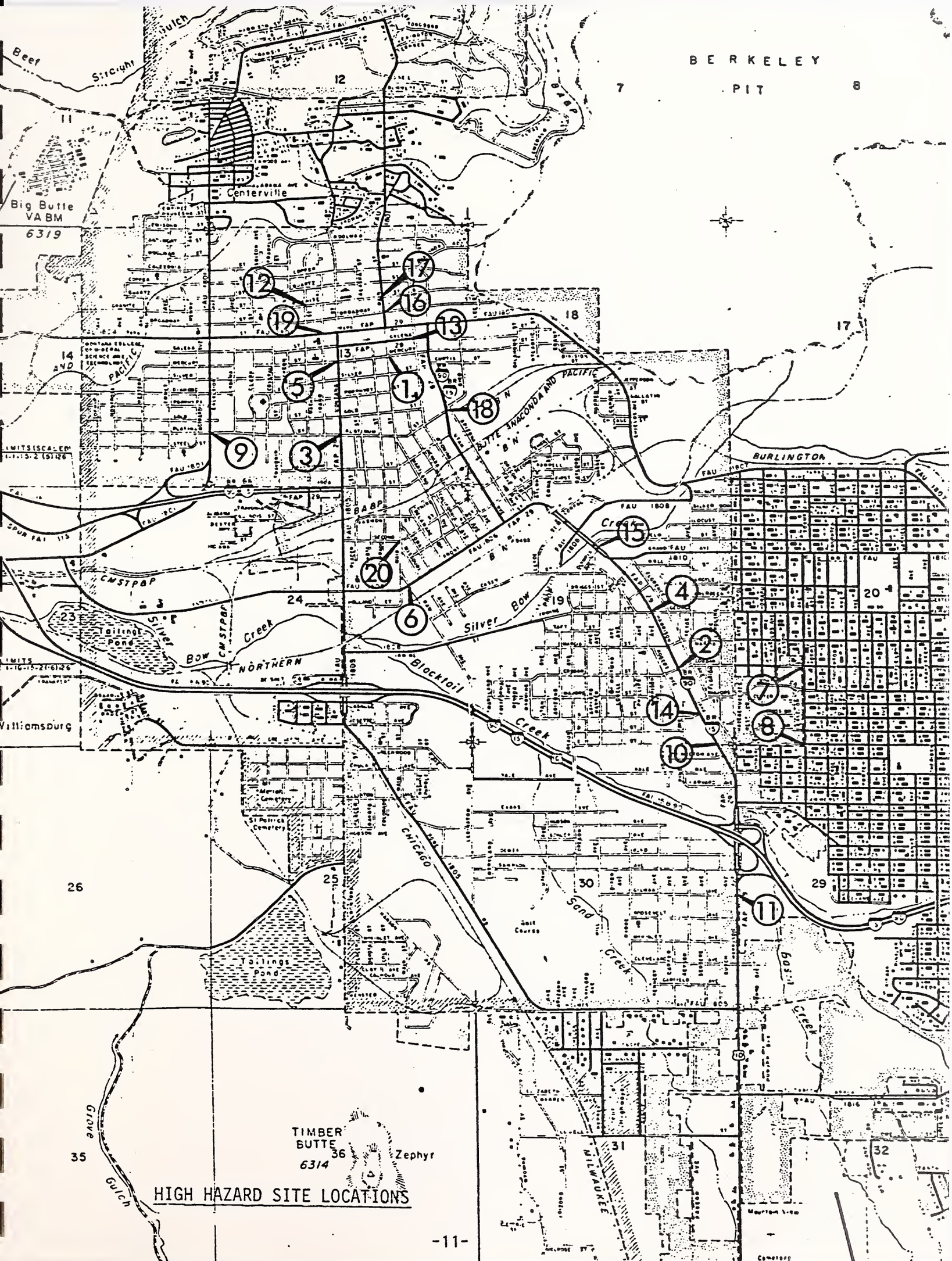
SITE LOCATIONS

The map on the following page indicate the site numbers at their respective locations.

The following is a list of site numbers for reference to the map:

HIGH HAZARD INTERSECTION LOCATIONS

1. Main - Mercury
2. Harrison - Cobban
3. Montana - Platinum
4. Harrison - George
5. Montana - Mercury
6. Front - Main
7. Farragut - Cobban
8. Farragut - Ottawa
9. Excelsior - Platinum
10. Harrison - Ottawa
11. Harrison - Gilman
12. Granite - Washington
13. Galena - Wyoming
14. Harrison - 'A'
15. Harrison - Olympia
16. Main - Broadway
17. Main - Granite
18. Utah - Platinum
19. Park - Idaho
20. Main - Second



HIGH HAZARD SITE LOCATIONS

HAZARD INDEX RANKING

Based on the hazard analysis for each site a matrix of indicator values and final hazard index ratings was constructed and a preliminary hazard index ranking was completed. Table 1 lists this ranking by site number, location, indicator values and hazard index. Also shown is statistical information for the indicator values and hazard index.

During the process of field data collection and subsequent indicator computations, it was discovered that the two entirely subjective indicators could vary widely between consecutive analyses among non-experienced observors. Butte-Silver Bow will most likely retain traffic personnel who will update the high hazard priority list and therefore these indicators should remain as part of the hazard index ranking.

TABLE 1

PRELIMINARY HAZARD INDEX RANKING

(7 Indicators - 88.6% Strength)

RANK	SITE NO.	SITE DESCRIPTION	INDICATOR VALUES NO. ACCIDENTS	ACCIDENT RATE	SEVERITY	VOL./CAP.	SIGHT DISTANCE	DRIVER EXPECT.	INFO. DEFICIENT	HAZARD INDEX
1	#12	Washington-Granite	45	67	46	16	86	75	50	55.85
2	#8	Farragut-Ottawa	42	55	44	19	87	72	58	53.08
3	#9	Excelsior-Platinum	47	40	50	28	83	78	50	52.09
4	#1	Main-Mercury	69	57	44	34	83	44	33	51.85
5	#13	Wyoming-Galena	46	56	42	19	82	62	55	51.35
6	#3	Montana-Platinum	65	34	43	46	91	50	44	49.58
7	#6	Main-Front	52	21	44	43	85	63	67	48.60
8	#2	Harrison-Cobban	68	28	44	49	91	50	38	48.47
9	#18	Utah-Platinum	41	25	47	27	92	72	62	48.23
10	#4	Harrison-George	54	21	47	46	87	67	33	46.57
11	#16	Main-Broadway	42	19	55	40	83	50	67	46.28
12	#11	Harrison-Gilman	45	16	50	35	73	62	55	44.39
13	#5	Montana-Mercury	52	26	43	36	87	50	42	44.28
14	#10	Harrison-Ottawa	47	15	44	41	78	62	55	44.22
15	#14	Harrison-'A'	46	18	44	40	83	62	45	43.86
16	#7	Farragut-Cobban	47	25	46	39	79	47	33	41.99
17	#20	Main-Second	37	21	45	26	87	55	42	41.02
18	#15	Harrison-Olympia	37	10	42	35	95	63	45	40.86
19	#17	Main-Granite	39	17	44	37	75	47	33	38.04
20	#19	Idaho-Park	39	22	42	32	84	38	33	37.71
	Average Value		48.0	29.65	45.3	34.4	84.6	58.4	47.0	46.42
	Range		37-69	10-67	42-55	16-49	73-95	38-78	33-67	37.71-55.85
	Standard Deviation		9.60	16.45	3.25	9.40	5.57	11.18	11.43	5.06

PRIORITY INDEX

Table 2 represents the tabular computation method used to develop the composite hazard index - cost-benefit index values. From this computation the final priority list was developed (Table 3).

It should be noted that the priority list contains only short term improvements. Since all long term improvements are major reconstruction projects based on future conditions of volume and use, a separate priority listing for long term improvements was assembled. Priorities rankings from the long term improvements list may be inserted into the short term improvements if Butte Silver Bow determines that the magnitude of funds necessary for their implementation are available. Table 4 presents the long term improvements priority list.

TABLE 2

PRIORITY INDEX COMPUTATION

HAZARD INDEX RANK	HAZARD INDEX	C/B RATIO	C/B INDEX	PRIORITY INDEX (.67 HI + .33 CB)	PRIORITY RANK	PRIORITY SITE
1	55.85	.1558	40	50.44	2	12
2	53.08	.3165	24	43.48	8	8
3	52.09	.2876	26	43.48	9	9
4	51.85	.1499	40	47.94	3	1
5	51.35	.0883	52	51.56	1	13
6	49.58	.1834	36	45.10	6	3
7	48.60	.2479	30	42.46	11	6
8	48.47	.1334	43	46.66	5	2
9	48.23	.3950	20	38.91	13	18
10	46.57	.1027	49	47.37	4	4
11	46.28	.1696	38	43.55	7	16
12	44.39	.3775	21	36.67	15	11
13	44.28	.1516	40	42.87	10	5
14	44.22	.3699	21	36.56	16	10
15	43.86	.2338	31	39.62	12	14
16	41.99	.3242	24	36.05	17	7
17	41.02	.4592	16	32.76	18	20
18	40.86	.2342	31	37.61	14	15
19	38.04	.3728	21	32.42	20	17
20	37.71	.3480	22	32.53	19	19

TABLE 3

PRIORITY LIST

(Short Term Improvements)

Priority		Site	Priority Index	*Estimated Cost
1	#13	Wyoming - Galena	51.56	$ 4,250
2	#12	Washington-Granite	50.44	8,050
3	#1	Main - Mercury	47.94	15,940
4	#4	Harrison - George	47.37	7,900
5	#2	Harrison - Cobban	46.66	8,610
6	#3	Montana - Platinum	45.10	13,240
7	#16	Main - Broadway	43.55	8,330
8	#8	Farragut - Ottawa	43.48	8,800
9	#9	Excelsior - Platinum	43.48	63,055
10	#5	Montana - Mercury	42.87	7,050
11	#6	Main - Front	42.46	12,070
12	#14	Harrison - 'A'	39.62	4,590
13	#18	Utah - Platinum	38.91	17,735
14	#15	Harrison - Olympia	37.61	5,050
15	#11	Harrison - Gilman	36.67	19,960
16	#10	Harrison - Ottawa	36.56	7,250
17	#7	Farragut - Cobban	36.05	14,130
18	#20	Main - Second	32.76	13,685
19	#19	Idaho - Park	32.53	6,390
20	#17	Main - Granite	32.42	9,935
		TOTAL COST SHORT TERM IMPROVEMENTS		$256,020

*Does not include: Administrative, Engineering, Replacement or Maintenance Costs.

TABLE 4

PRIORITY LIST

(Long Term Improvements)

Priority		Site	Priority Index	Estimated Cost
1	#3	Montana - Platinum	40.77	$ 140,680
2	#2	Harrison - Cobban	40.72	116,700
		TOTAL COST LONG TERM IMPROVEMENTS		$ 257,380

IMPLEMENTATION

The priority lists have been arranged in a manner that budget considerations can readily be applied in the decision to proceed with improvements. The priority ranking should be the major consideration in selecting which sites will be receiving funds first. However, when limited funds are available it may be wise to skip over one or two projects to improve a greater number of sites.

As an example, Butte-Silver Bow may budget $38,000 the first year. It would be logical to proceed through the priority list totaling project costs. By the time priority Site 4 was included, the total would be $36,140. If priority Site 5 were added the total would exceed the budget by $6,750. Rather than underspend the budget, priority Site 4 could be skipped and priority Sites 5 and 7 could be completed that year. The following year, priority Site 4 would become priority Site 1 and 6 would become priority Site 2, and the same budget procedure used to work through the list.

PROGRAM CONTINUATION

Since the basic format of the study has been outlined and an initial priority list established, continuance of the program is strongly advised. The findings and recommendations of this study will soon become obsolete without continued updating at least on an annual basis.

The following recommendations in the continuance of the program are offered to Butte Silver Bow:

1. The Police Department should continue to be assessed for copies of accident reports.

2. One person should be assessed with the responsibility of the program to insure that all data is being supplied, processed and filed.

3. An accident cluster map should be maintained.

4. Criteria should be developed for the inclusion of additional sites to be analyzed.

5. Coordinate any traffic counting programs that may exist or establish a counting program.

6. Analyze new sites according to the procedures of this study and include them in the priority list when warranted.